CHAPTER B4

HEARING CONSERVATION

B0401. DISCUSSION

The goal of Hearing Conservation (HC) is to prevent occupational hearing loss and assure auditory fitness for duty of all Navy personnel.

Noise-induced hearing loss is the Fleet's number one occupational health hazard. High intensity noise exposure results from a wide variety of shipboard operations, including gun or missile fire, aircraft noise, and ship's propulsion systems. Operational risk assessment has shown that Fleet costs in terms of man hours, personal hearing protector purchases, and noise abatement operations are readily offset by the preservation of effective communication, maintained quality of life, and reduction in disability expense which accompany an effective HC process. As such, it is incumbent upon leadership to set the right example in their personal protective practices, to enforce compliance, and to ensure HC receives their full support.

B0402. HEARING CONSERVATION RESPONSIBILITIES

a. **The commanding officer shall** ensure that HC is established and maintained within the command.

b. **The safety officer shall**:

(1) Request assistance from an industrial hygienist or occupational audiologist to conduct noise measurement and exposure analysis (survey) of areas and equipment per paragraph B0404.

(2) Maintain a record of noise hazardous areas and equipment. The baseline or subsequent industrial hygiene surveys, where available, shall serve as documentation. Ensure that noise hazardous spaces/equipment are posted and labeled accordingly.

(3) Ensure that all permanent threshold shifts reported by medical are reported to the Naval Safety Center as a Special Case Mishap per A0603b(4).

c. **Industrial hygiene officers shall:**

(1) Maintain and ensure proper calibration of sound level measuring equipment.

(2) Annually, certify audiometric testing booths installed aboard the ships.

d. **Division officers shall**:

(1) Ensure personnel exposed to hazardous noise have and properly use hearing protection devices.

(2) Ensure, that a space or piece of equipment that is designated as noise hazardous is properly posted and labeled.

(3) Ensure all personnel required to wear personal hearing protection are trained in the use and maintenance of that protective equipment, regardless of whether they require enrollment in HC.

(4) Ensure personnel report for scheduled audiometric testing and training.

(5) Ensure that personnel who require hearing retests are excluded from hazardous noise for at least 14 hours before the scheduled test date/time. Per Appendix B4-A, hearing protective devices may not be used to meet this requirement.

(6) Coordinate with the medical department representative to identify personnel routinely exposed to hazardous levels of occupational noise.

e. **The Medical Department Representative (MDR) shall**:

(1) Coordinate with division officers to identify and maintain a current roster of personnel routinely exposed to hazardous levels of occupational noise, as guided by the baseline or other industrial hygiene surveys. In the absence of an appropriate industrial hygiene survey, or when it is clear that personnel have some level of exposure to hazardous noise, but on an infrequent or short-term basis, consult an industrial hygienist, occupational audiologist, or occupational medicine physician to determine the need for enrollment. The consultation may be informal (example, by email) as long as a printed record of the request and reply are available for retention by both parties. Convenience shall not be a criteria to determine inclusion in HC.

(2) Conduct orientation to HC and personal hearing protection for all hands during indoctrination.

(3) Ensure annual refresher training, per B0408b for the HC-enrolled personnel is performed. Reference B4-1 identifies suitable training materials and provides additional guidance.

(4) Consult the command industrial hygiene survey, or an occupational health professional to determine the type of required hearing protective devices required for personnel. Maintain an adequate stock and fit all sized, non-disposable hearing protective devices.

(5) Schedule personnel in HC for annual audiometric testing. Ensure that monitoring results have been entered into each individual’s health record, and that any necessary follow-up actions are completed.

(6) Ensure supervisors are notified that personnel who require hearing re-tests are excluded from hazardous noise duties for at least 14 hours prior to the scheduled test date/time. Hearing protective devices may not be used to meet this requirement.

(7) If audiometric testing is performed within the MDR's command, ensure calibration of audiometers, certification of the test chamber, and training of audiometric technicians.

NOTE:

Reference B4-1 is available for additional information.

(8) Report all permanent threshold shifts toward deteriorated hearing, which have been determined to be consistent with occupational origin, to the safety officer.

f. **All hands shall**:

(1) Comply with hazardous noise labels wherever they appear, either in spaces or on equipment, and properly wear assigned hearing protective devices.

(2) Undergo hearing testing when designated.

B0403. HEARING CONSERVATION ELEMENTS

Hearing conservation includes the following elements:

a. Noise measurement and exposure analysis to identify hazardous noise areas or sources and the personnel exposed

b. Application of engineering controls to reduce hazardous noise to the maximum extent feasible

c. Use of hearing protective devices as an interim measure where engineering controls are not feasible (paragraph B0406)

d. Periodic hearing testing of all personnel at risk to monitor the effectiveness of the process, and timely audiologic and medical evaluation of those personnel who demonstrate significant hearing loss or threshold shift (paragraph B0407)

e. Training regarding potentially hazardous noise areas and sources, use and care of hearing protective devices, the effects of noise on hearing, and the command's HC process (paragraph B0408).

B0404. NOISE MEASUREMENT AND EXPOSURE ASSESSMENT

To effectively control noise, it is necessary that the noise be accurately measured according to standard procedures and that the measurements be properly evaluated against accepted criteria.

a. **Noise Measurements.** Noise measurements shall be taken as part of the industrial hygiene survey described in Chapter A3 of this instruction. A noise survey is required if one has not been performed, if the ship has completed a repair availability with significant work done on engineering systems, or if new equipment has been installed. These measurements shall be taken by an industrial hygienist, occupational audiologist or by other trained personnel under the supervision of an industrial hygienist or occupational audiologist. Detailed information on noise measurements may be found in Appendix B4-A. The safety officer shall retain a copy of noise measurement data per B0409.

b. **Exposure Assessment**

(1) The analysis of noise measurements to assess the hazard potential is a complex task that shall be performed by an industrial hygienist or occupational audiologist. The exposure assessment shall be accomplished per reference B4-2.

(2) The criteria outlined in Appendices B4-A and B4-B shall also be used to determine the degree of compliance with applicable standards.

(3) In the absence of an industrial hygienist's or occupational audiologist's assessment to the contrary, personnel who routinely work in noise hazardous areas or with equipment that produces hazardous noise as defined in Appendix B4-A, shall be included in HC. Implementation of all available measures may not be necessary in every case. For example, visitors to a noise hazardous area should be required to wear hearing protective equipment, but would not be required to have their hearing tested or be included on a roster of noise exposed personnel. See Appendix B4-A for additional information.

(4) Information regarding removal of personnel from HC is provided in Appendix B4-A.

c. Labeling of Hazardous Noise Areas and Equipment

(1) Designated hazardous noise areas and equipments that produce hazardous sound levels (see Appendix B4-A) shall be appropriately labeled. NAVMED 6260/2, Hazardous Noise Warning Decal (8" x 10") NSN 0105-LF-004-7200 and the NAVMED 6260/2A, Hazardous Noise Labels (2" x 2") NSN 0105-LF-004-7800, are the approved decals and labels for marking hazardous noise areas and equipment.

(2) Normally the outside of doors/hatches leading into a noise hazardous area shall be posted. However, weather surfaces of a ship shall not be posted. In the event that a particular area is a noise hazardous area and has an entrance from a weather deck, the inside of the weather deck door/hatch shall be posted.

(3) Exteriors of military combatant equipment are excluded from this labeling requirement. However, personnel operating and maintaining combat equipment must be made fully aware of hazardous noise exposure conditions.

B0405. NOISE ABATEMENT

a. Reduction of noise at the source is in the best interests of the Navy and its personnel. Areas and equipment that contain or produce potentially hazardous noise should be modified to reduce noise levels to within acceptable limits wherever it is technologically and operationally feasible.

b. Noise abatement actions will normally be accomplished during ship or equipment design, construction or testing. Hazardous noise areas/equipment not identified during construction or post overhaul noise surveys are most likely due to malfunctioning equipment. Noise abatement actions recommended by the industrial hygienist or resulting from Board of Inspection and Survey (INSURV) inspections shall be documented as required in Chapter A4 of this instruction, and implemented as soon as possible.

c. Additional information on noise abatement is available in Appendix B4-C.

B0406. PERSONAL HEARING PROTECTIVE DEVICES

a. Personnel working in or entering designated hazardous noise areas or utilizing noise hazardous tools or equipment shall have hearing protective devices available at all times, and wear them without consideration of the duration of the exposure. Exceptions to this requirement must be documented by a qualified professional.

b. A combination of insert type and circumaural (muff) type hearing protective devices (double protection) shall be worn:

(1) In all areas where sound levels exceed 104 dB(A), unless an occupational audiologist, industrial hygienist, or occupational medicine physician has determined that single protection is adequate for the anticipated duration of the exposure.

(2) When a medical officer or audiologist determines that double protection is required.

c. All personnel exposed to gunfire in a training situation or to noise from large caliber gun or missile firing, under any circumstances, shall wear sufficient hearing protective devices to reduce noise at the ear to safe exposure levels.

d. Assistance in the determination of which hearing protective device, or combination of devices, suitable for use in each situation is available from an occupational audiologist, industrial hygienist, or occupational medicine physician. Every effort shall be made to issue personal hearing protective devices suited to the location and duration of usage following the guidance contained in Appendix B4-D. Appendix B4-D identifies standard stock hearing protective devices. Alternative hearing protective devices that have been evaluated and approved by one of the Military Services are identified on the Navy Environmental Health Center (NEHC) homepage at http://www.nehc.med.navy.mil.

e. For situations requiring unique hearing protection devices, guidance and approval shall be requested from Chief, Bureau of Medicine and Surgery (BUMED).

f. In cases where an industrial hygienist, occupational medicine physician or occupational audiologist determines that hearing protective devices do not provide sufficient attenuation to reduce the individual's effective exposure level to below 84 dB(A), administrative controls as discussed in Appendices B4-B and B4-C will be required.

B0407. HEARING TESTING AND MEDICAL EVALUATION

Personnel who are routinely required to work in designated noise hazardous areas or with labeled noise hazardous equipment shall be entered into HC. Appendix B4-A provides detailed information on hearing testing.

a. **Reference (Baseline) Hearing Tests.** All personnel shall receive a baseline hearing test upon entry into naval service recorded on a Reference Audiogram (DD Form 2215). Hearing tests performed at Military Entrance Processing Stations (MEPS) shall not be used as a baseline hearing test.

b. **Monitoring Hearing Tests.** All personnel assigned to duties in designated noise hazardous areas or operating noise hazardous equipment shall be included in HC. These persons shall receive a hearing test annually, unless their exposure has been found to be of insufficient intensity and/or duration to require enrollment, based on a noise survey or the written opinion of an appropriate occupational health professional. Test results shall be recorded on a Hearing Conservation Data Form (DD Form 2216). Placement in HC and annual hearing tests shall continue for as long as the person remains in a noise hazardous environment.

c. **Termination Hearing Tests.** Personnel shall receive a hearing test upon termination of service.

d. **Other Hearing Tests.** Hearing tests performed for reasons other than hearing conservation or routine physicals, such as complaints of hearing difficulties, difficulty understanding conversational speech or a sensation of ringing or fullness in the ear(s), shall be performed as indicated by a Medical Provider. The results of these tests should be recorded on a Standard Form (SF 600) and maintained in the health record.

B0408. TRAINING

a. All personnel included in HC shall receive training relative to HC prior to working in noise hazardous areas or with noise hazardous equipment and annually thereafter. Initial training topics shall include:

(1) The elements and rationale for HC including the effects of noise on hearing

(2) Designated noise hazardous areas and equipment

(3) Proper use and maintenance of hearing protective devices, including the advantages and disadvantages of each type of device

(4) The necessity for periodic hearing testing, and a description of test procedures

(5) Mandatory requirement to wear assigned protective equipment, and administrative actions that may result from failure to comply

(6) Off-duty hearing health hazards

(7) The effects of hearing loss on career longevity, promotion and retention.

b. Refresher training for the HC-enrolled personnel will be performed in conjunction with the annual audiogram. Reference B4-1 identifies suitable training materials and provides additional guidance.

B0409. RECORDKEEPING

a. Results of hearing tests performed for hearing conservation purposes and the results of exposure assessments shall be permanently recorded and retained in the member's health record. Baseline and reference audiograms which have been superceded as a result of the follow-up process shall be retained in the individual's health record along with relevant evaluation, disposition and referral notations.

b. Activities using the Defense Occupational Health Readiness System-Hearing Conservation (DOHRS-HC) will upload their data to the warehouse as directed by the regional occupational audiologist. Activities that do not use DOHRS-HC should contact NAVENVIRHLTHCEN for guidance in including test data in the Hearing Conservation Database.

c. The MDR shall maintain a current roster of personnel who routinely work in designated noise hazardous areas and shall update this roster semi-annually. The MDR shall maintain a "tickler file" for scheduling annual audiometric examinations of these personnel. The MDR shall update the "tickler file" monthly with the results of the audiometric exams.

CHAPTER B4

REFERENCES

B4-1 NEHC Technical Manual, TM-6260.51.99-1, Navy Medical Department Hearing Conservation Program Procedures (NOTAL)

B4-2 NEHC Technical Manual, TM-6290.91-2, Rev. B (1999), Industrial Hygiene Field Operations Manual (NOTAL)

B4-3 American National Standard Specification for Sound Level Meters, S1.4A-1985, American National Standards Institute (NOTAL -- Should be held by commands with sound level meters).

B4-4 American National Standard Specification for Personal Noise Dosimeters, S1.25-1991, American National Standards Institute (NOTAL -- Should be held by commands with personal noise dosimeters).

B4-5 DODINST 6055.12 of 22 April 1996, “DOD Hearing Conservation Program (HCP)” (NOTAL)

B4-6 American National Standard Specification for Audiometers, S3.6-1989, American National Standards Institute (NOTAL -- Should be held by commands with audiometers).

B4-7 OPNAVINST 4720.2G, "Fleet Modernization Program Policy".

Appendix B4-A

HEARING CONSERVATION DETAILED INFORMATION

This appendix provides detailed information regarding hearing conservation that will be of value to the ship's Medical and Safety Departments.

1. **Navy Occupational Exposure Level (NOEL).** The NOEL for occupational exposure to noise is listed below:

a. For an 8-hour time-weighted average (TWA) in any 24-hour period: 84 dB(A)

b. For periods of less than 16 hours in any 24-hour period, the NOEL can be determined from the following equation:

$$T = 16/2\ [(L - 80)/4]$$

Where: T = time in hours (decimal)

L = effective sound level in dB(A)

NOTE:

When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect must be considered. If the sum of the following expression exceeds unity, then the mixed exposure exceeds the NOEL:

$$C1/T1 + C2/T2 + \ldots Cn/Tn$$

Where C indicates the total time of exposure at a specified noise level and T represents the time of exposure permitted at that level.

c. For impact or impulse noise - 140 dB(A) peak sound pressure level.

d. When TWA exposures are likely to exceed 84 dB(A), then personnel shall be included in Hearing Conservation.

2. **Noise Measurements and Exposure Assessments.** To effectively control noise it is necessary to accurately measure noise according to standard procedures and properly evaluate the measurements against accepted criteria.

a. **Noise Measurements.** Noise measurements shall be taken as a part of the industrial hygiene survey described in Chapter A3.

(1) Sound level meters shall conform, at a minimum, to the Type II requirements cited in reference B4-3. An acoustical calibrator, accurate to within plus or minus one decibel, shall be used to calibrate the instrument before each survey and to revalidate the calibration at the conclusion of the survey. The sound level meter and acoustical calibrator will be electroacoustically calibrated annually. Contact NAVENVIRHLTHCEN Norfolk to schedule the calibration of this equipment.

(a) Continuous or intermittent steady state noise shall be measured in dB(A) with a sound level meter set for slow response. Whenever levels in excess of 84 dB(A) are recorded, C-weighted measurements, dB(C) shall also be taken to permit more accurate determination of hearing protector attenuation requirements.

(b) Impact or impulse noise shall be measured as dB peak sound pressure level (reference: 20 μPa) with an instrument capable of accurate impact noise measurement. Reference B4-3 provides specific details.

(2) In cases where high worker mobility, significant variations in sound levels, or a significant component of impulse noise make area monitoring generally inappropriate, personal dosimetry shall be conducted. Personal noise dosimeters shall meet the class 2A-84/80-4 requirements of reference B4-4 and have an operating range of at least 80 dB(A) to 130 dB(A).

(3) Work environments found to have noise levels greater than 84 dB(A) (continuous or intermittent), or 140 dB peak sound pressure level for impact or impulse noise shall be analyzed to determine the potential hazard and shall be resurveyed within 30 days of any significant modifications or changes in work routine which could impact/alter the noise intensity/exposure level.

(4) All noise measurements taken to determine an individual's exposure shall be conducted with the microphone of the measuring instrument placed at a height which most closely approximates the position/location of the worker's ear during normal working conditions. Repeated measurements may be required during a single day and/or on different days of the week to account for the variations in noise levels produced by changes in operational schedules and procedures.

(5) The record of noise measurements shall be kept by the measuring activity for a period of 50 years. If measurements are made by a ship's IHO, the records shall be turned over to a supporting shore medical activity for retention. The shore activity will establish a file for each ship. Records shall include, as a minimum the number, type, and location of the noise sources; number and identification of personnel in the work area and their daily noise exposure and duration; type, model, serial number of test equipment, and calibration data; location, date, and time of noise measurements; noise levels measured and hazard radius; and the name and signature of the person(s) who made the survey. Noise survey data may be recorded on NEHC 5100/17 and 5100/18 or DD 2214 as applicable.

b. **Exposure Assessment.** The specialized equipment to be used by an industrial hygienist or occupational audiologist may include octave band analyzers, recorders and personal noise dosimeters.

(1) The criteria outlined in paragraph 1, Navy Occupational Exposure Limits (NOEL) shall be used to determine the degree of compliance with applicable standards.

(2) A noise hazardous area is defined as:

(a) Any work area where the A-weighted sound level (continuous or intermittent) is routinely greater than 84 dB(A).

(b) Any work area where the peak sound pressure level (impulse or impact noise) routinely exceeds 140 dB.

NOTE:

Routinely is defined as those areas/equipment where the noise is of sufficient intensity and duration that it can reasonably be expected exposure will result in a loss of hearing sensitivity.

(3) Noise hazardous equipment is that which produces sound levels greater than 84 dB(A) or 140 dB peak sound pressure level.

(4) Per reference B4-5, 8-hr time-weighted average (TWA) noise levels shall be determined for all personnel working in noise hazardous areas at least once during assignment and within 30 days of any change in operations affecting noise levels.

(5) A risk assessment code (RAC) shall be assigned to all potentially hazardous noise areas and operations (see chapter A4). This will normally be accomplished as part of the Industrial Hygiene Surveys described in chapter A3.

(6) Since there are a wide variety of noise measuring instruments in use, any one of the following methods should be used. In each case, it is necessary to take a sufficient number of measurements to achieve a representative noise sample.

(a) When using a dosimeter that is capable of C-weighted measurements:

1. Obtain the C-weighted dose for the entire workshift, and convert to TWA sound level (see dosimeter instruction manual for conversion table).

2. Subtract the NRR from the C-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(b) When using a dosimeter that is not capable of C-weighted measurements, the following method may be used:

1. Convert the A-weighted dose to TWA (see dosimeter instruction manual).

2. Subtract 7 dB from the NRR value.

3. Subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(c) When using a sound level meter set to the A-weighting network:

1. Obtain the A-weighted TWA.

2. Subtract 7 dB from the NRR and subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(d) When using a sound level meter set on the C-weighting network:

1. Obtain a representative sample of the C-weighted sound levels in the environment.

2. Subtract the NRR from the C-weighted average sound level to obtain the estimated A-weighted TWA under the ear protector.

The effective reduction of any combination of insert plugs with circumaural muffs (double protection) is considered to be approximately 30 dB. If the result of subtracting the estimated reduction value of a particular device or combination of devices from the measured workplace sound level is determined to be below 84 dB(A) or 140 dB peak, the protection is considered to be adequate. However, should the 8-hour (protected) TWA exceed 84 dB(A), administrative controls shall be instituted to reduce personnel exposure to acceptable levels.

c. **Removal of Personnel from Hearing Conservation.** A conservative approach will be taken in making a decision to remove personnel from hearing conservation.

(1) Judgments shall be based on repeated and representative measurements that indicate that the individual is exposed to less than 70 percent noise dose or has an 8-hour time-weighted average (TWA) of less than 82 dB(A). This ensures, with an approximate 95 percent confidence level, that individuals will not be overexposed.

(2) Recommendations for removal of individuals who are already included in the hearing conservation will be made only by professionals qualified to perform or evaluate noise exposure assessments. In no case will individuals already included in hearing conservation be disenrolled based upon exposure assessment alone without concurrence from an audiologist or qualified physician. Such concurrence is necessary to avoid exclusion of personnel who are noise susceptible or at exceptional risk due to pre-existing hearing loss. See paragraph 4d for hearing tests for personnel being removed from hearing conservation.

3. **Personal Hearing Protective Devices.** In cases where personal hearing protection devices do not sufficiently reduce personnel effective exposure levels to less than 84 dB(A) administrative control of exposure time will be necessary. A table of noise exposure limits is found in Appendix B4-B.

4. **Hearing Testing and Medical Evaluation**

a. **Hearing Test.** Audiometers used in the performance of hearing tests shall conform to the standards defined in the most current edition of reference B4-6. Hearing tests shall be pure tone, air conduction hearing threshold examinations to include, as a minimum, test frequencies of 500, 1,000, 2,000, 3,000, 4,000 and 6,000 Hz and shall be taken separately for each ear. Tests shall be performed by an audiologist, otolaryngologist, qualified physician or by a person certified by the NAVENVIRHLTHCEN Norfolk or the equivalent organization of another US military service. Hearing tests shall be conducted in an audiometric chamber with internal ambient sound levels not exceeding those prescribed in reference B4-5.

(1) Audiometric booths must be certified annually by an industrial hygienist, audiologist or other qualified personnel under their direct supervision.

(2) The use of noise excluding audiometric earphones is not permitted to augment the performance of a deficient (e.g., non-certifiable) audiometric test room. Their use for minimizing ambient noise masking effects during testing is allowed within a certified room.

b. **Reference (Baseline) Hearing Tests**

(1) All personnel included in hearing conservation shall have a reference hearing test (form DD 2215) in their medical record.

(2) All reference hearing tests shall be preceded by at least 14 hours without exposure to workplace noise. This requirement may not be met by wearing hearing protective devices. Reference (baseline) hearing tests will not be conducted if there is evidence of a transient medical condition that would affect hearing threshold.

(3) Personnel who do not have a reference audiogram filed in their health record shall not be assigned to duty in a designated hazardous noise area involving exposure to hazardous noise until a reference hearing test has been performed. In these cases, hearing threshold levels in either ear in the excess of an average of 25 dB for the frequencies of 500 - 3000Hz or 45dB at any frequency greater than 4000Hz must be evaluated by an audiologist.

c. **Monitoring Hearing Test**. All personnel included in hearing conservation will receive annual monitoring hearing tests for as long as they remain enrolled, unless otherwise indicated in the following paragraphs. Additional hearing tests may also be conducted when there are individual complaints of hearing difficulties, i.e., difficulty in understanding speech or a sensation of ringing or fullness in the ear(s). At the discretion of an audiologist or medical officer, evaluation and medical record entries will be necessary to discover and document the existence of occupational versus non-occupational etiology.

NOTE:
All personnel shall bring their personal hearing protective devices with them when they report for monitoring audiometry.

(1) Consult reference B4-1 for detailed Medical Department guidance for the provision of monitoring audiometry, follow-up testing, and case management of personnel with noise-induced hearing loss.

(2) The monitoring audiogram shall be compared to the most current reference audiogram to determine if a significant threshold shift (STS) has occurred.

(a) Significant threshold shift (STS) is defined as a change of 15 dB or greater at any test frequency from 1000 to 4000 Hz in either ear or a change in hearing averaging 10 dB or more at 2000, 3000 and 4000 Hz in either ear.

(b) When an STS is identified, additional monitoring

hearing tests shall be performed to determine if the threshold shift is temporary or permanent in nature. The member's division officer or MDR will be informed of the time and place for follow-up testing.

(c) A significant threshold shift will be considered permanent when so determined by an audiologist or appropriately trained physician. Individuals will be informed in writing within 21 days of any permanent threshold shift toward deteriorated hearing. When the permanent threshold shift results from exposure to hazardous noise levels, the hearing loss shall be reported to the safety officer and department head by memo that a possible breach in the Hearing Conservation control procedures has occurred, resulting in a hearing loss.

(3) Any individual who has hearing loss in both ears in which the sum of thresholds at the frequencies of 3000, 4000 and 6000 Hz exceeds a total of 270 dB or has their reference hearing test (form DD 2215) re-established three times will not be assigned to duties involving exposure to hazardous noise until evaluated and waived by an audiologist, otologist, or occupational medicine physician.

d. **Removal Hearing Tests.** Individuals who are removed from hearing conservation will be given a hearing test to document auditory status at the time of removal from noise hazardous duties. Results of this test will be recorded on DD 2216.

e. **Disposition Following Monitoring Hearing Tests.** Pure tone air conduction monitoring hearing tests are designed to detect small changes in hearing and identify problems before the individual suffers hearing loss that interferes with verbal communications. Detection is made by comparing the current monitoring audiogram with the reference audiogram to determine STS.

(1) Annual

(a) If the annual audiogram shows no significant threshold shift, the individual shall be returned to duty and recalled for hearing testing in 1 year.

(b) If the annual audiogram shows STS toward improved hearing, then the individual should be re-tested immediately to determine if the baseline/reference test was in error, hearing has actually improved, or the annual test was invalid. If the repeat audiogram continues to show STS and is plus or minus 5dB from the annual test, re-establish the reference based on the first follow-up test and repeat the test in 1 year. Nothing else is required.

(c) If the annual audiogram shows a significant threshold shift toward deteriorated hearing, then the individual must be re-tested following at least 14 hours of exclusion from noise levels in excess of 80 dB(A). Because the presence of a STS implies that hearing protective equipment used may be inadequate, physical exclusion from noise may not be accomplished by the use of hearing protective equipment. The physical exclusion period is referred to as "auditory rest." The required 14 hours of "auditory rest" is usually sufficient to allow a temporary STS to return to pre-exposure levels.

(2) Follow-up No. 1

(a) If the first follow-up audiogram shows no significant threshold shift relative to the reference audiogram (ie. STS has resolved), personnel shall have their hearing protective devices refitted, be re-indoctrinated in their use, and returned to duty to be recalled for a hearing test in 1 year.

(b) If the first follow-up supports the existence of STS, then a possible conductive or mechanical basis for the shift must be ruled out before proceeding with follow-up. The preferred method to rule out conductive hearing loss is through screening tympanometry and otoscopy, provided by the audiometric technician or MDR. Subjects who demonstrate normal otoscopy and tympanometry should have that fact noted on a SF 600, and may then immediately receive their second follow-up hearing test. If tympanometry is unavailable, then any health care provider can provide examination and clearance to continue the audiometric test sequence. Otoscopic/tympanometric anomaly requires medical evaluation prior to resuming the test sequence. Again, the second follow-up may be given on the same day as the first follow-up if middle ear function is normal.

(c) At any point in the monitoring process, a health care provider has the option of discontinuing the sequence and referring the patient to an audiologist for further evaluation, if results appear invalid or a severe condition is suspected.

(3) Follow-up No. 2

(a) If the second follow-up test shows no STS relative to the reference audiogram, personnel shall have their hearing protective devices refitted, be re-trained in their use, and be returned to duty.

(b) If the second follow-up test continues to show STS relative to the reference audiogram, the health care provider will refer the individual for diagnostic evaluation or consultation with an audiologist. However, for personnel who continue to demonstrate essentially normal hearing sensitivity despite their threshold shift, the audiologist or suitably trained physician who would otherwise receive the referral may elect to provide a written protocol for case management. The protocol may include the option of shipboard counseling and revision of the reference audiogram without additional testing or review.

f. **Termination Hearing Tests**. Personnel shall receive a hearing test upon termination of service.

Appendix B4-B

ADMINISTRATIVE CONTROL OF NOISE EXPOSURE WITH HEARING PROTECTIVE DEVICES (STAY TIME)

	Limiting time (hr:min per 24 hour day)			
Sound level	Hearing protector noise reduction (dB)			
dB(A)	10	20	30	40
90	16	--	--	--
94	8	--	--	--
98	4	--	--	--
102	2	11:18	--	--
106	1	5:39	--	--
110	0:30	2:49	16	--
114	0:15	1:25	8	--
118	--	0:42	4	--
122	--	0:21	2	11:18
126	--	--	1	5:39
130	--	--	0:30	2:49
134	--	--	0:15	1:25
138	--	--	--	0:42

NOTE: Values other than those given above may be calculated using the formula:

$$T = 16/2\ [(L-80)/4]$$

Where: T = Time in hours (decimal)
L = Effective sound level, (dB(A))

Intermediate values may be interpolated by adding or subtracting the decibel difference to the appropriate column.

Appendix B4-C

ADDITIONAL NOISE ABATEMENT INFORMATION

1. **Introduction.** The primary means of protecting Navy personnel from hazardous noise levels shall be through the application of engineering controls. Administrative controls (e.g., the adjustment of work schedules to limit exposure) are also effective but often result in some loss in productivity. Personal protective equipment (earplugs or muffs) shall be the permanent solution only when engineering or administrative controls are considered to be infeasible or cost prohibitive. General hazard (including noise) control techniques are discussed in more detail in Chapter A3; therefore, this chapter will address only specific concepts.

2. **Preventive Measures.** It is much less costly to eliminate potential noise problems in the design or procurement stage for new processes, equipment, and facilities than it is to make retrofits or modifications after the fact. The following guidance is provided to meet this objective.

a. **Procurement specifications** for all new machinery and equipment to be located in spaces where personnel are required to perform work shall prescribe the lowest noise emission level that is technologically and economically feasible. The objective is to ensure, if feasible, an A-weighted sound level of 84 dB or less at all locations in which personnel are required to work.

b. **New ship design**

(1) Low noise emitting equipment and acoustical treatment shall be incorporated during the various design stages for all new construction ships so that the equivalent noise level at watchstander stations is less than 84 dB(A) under full power operating conditions where economically and technologically feasible. In any case, watchstander stations will not exceed a maximum, equivalent noise level of 90 dB(A) at the sustained speed operating conditions.

(2) Procurement specifications for all new machinery and equipment to be located in spaces where personnel are required to perform work shall prescribe the lowest noise emission level that is technologically and economically feasible. The objective is to ensure, if feasible, an A-weighted sound level of less than 84 dB at all locations in which personnel are required to work.

c. **Repeat ship design.** The policy cited above shall apply and incorporate the noise control technology learned from previous ship designs.

d. **Ship alteration.** Ship alteration prioritization policy established in reference B4-7 shall form the basis of selecting ships for noise control. All watchstander stations in machinery spaces will not exceed a maximum, equivalent noise level of 90 dB(A) under full power operation conditions where economically and technologically feasible. In any case, watchstander stations will not exceed a maximum, equivalent noise level of 90 dB(A) at sustained speed operating conditions.

e. The policy stated in paragraphs 2b, c, and d does not apply to high performance ships, experimental ships or special purpose ships for which noise

reduction technology application is not feasible. In these uniquely military situations, COMNAVSEASYSCOM, in conjunction with BUMED, will study and develop suitable noise requirements, engineering controls, and hearing protective devices to protect personnel from hazardous noise levels based on ship operating requirements and personnel rest-duty cycles.

3. **Abatement of Existing Noise Hazards**

a. Abatement of hazardous noise levels shall be undertaken, to the extent possible or practicable, by one or more of the following methods:

(1) By engineering design to eliminate or reduce the noise level of machinery, equipment, and other operating devices/facilities to acceptable levels

(2) By damping the noise by means of lamination, mufflers, mountings, couplings, supports, insulation or application of acoustic materials

(3) By acoustical enclosure of the noise producer

(4) By isolation of the noise producer to a point where the noise will affect fewer personnel

(5) By substitution of less noisy operations (e.g., welding in lieu of riveting)

(6) By administrative controls which limit exposure (e.g., control of work schedules).

Appendix B4-D

HEARING PROTECTIVE DEVICES

	Manufacturers Nomenclature/NSN	Type of Protector	Federal Nomenclature
1	Ear Defender V-51R 6515-00-442-4765	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (X-Small) (White)
2	Ear Defender V-51R 6515-00-467-0085	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Small) (Green)
3	Ear Defender V-51R 6515-00-467-0089	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Medium) (Intl. Orange)
4	Ear Defender V-51R 6515-00-442-4807	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Large) (Blue)
5	Ear Defender V-51R 6515-00-442-4813	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (X-Large) (Red)
6	Comfit, Triple Flange 6515-00-442-4821	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Small) (Green)
7	Comfit, Triple Flange 6515-00-442-4818	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Medium) (Intl. Orange)
8	Comfit, Triple Flange 6515-00-467-0092	Insert Earplug (sized)	Plug, Ear, Noise Protection 24's (Large)(Blue)
9	Silaflex (Blister Pack) 6515-00-133-5416	Non-Hardening Silicone	Plug, Ear, Noise Protection, Cylindrical, Disposable 200's
10	EAR or Deci-Damp 6515-00-137-6345	Foam Plastic Insert	Plug, Ear, Noise Universal Size, Yellow 200 pr
11	Sound-Ban 6515-00-392-0726 6515-00-181-8058	Headband, Earcaps	Plug, Ear, Hearing Protection Universal Size

	Manufacturers Nomenclature/NSN	Type of Protector	Federal Nomenclature
12	Straightaway Muffs 4240-00-759-3290 4240-00-674-5379 4240-00-979-4040	High Performance Circumaural Muffs For 9 AN/2 For 9 AN/2	Aural Protector Sound 372-9 AN/2 Replacement Filler, Dome Replacement Seal, Dome
13	Ear Plug Cases 6515-01-100-1674	--	Case, Earplug
14	Circumaural Muff 4240-00-22-2946	Type II Headband/Napeband	Aural Protector, Sound

POSITIVE AND NEGATIVE FEATURES OF HEARING PROTECTIVE DEVICES

Type Wear	Positive	Negative	Length of Wear
Earplug (V-51R or Triple Flange)	After adaptation can be used for long periods. Relatively inexpensive	Individual fitting by medical personnel. May cause initial soreness/irritation	Long term (3-4 hours)
Headband Ear Caps (Sound-Ban)	Quickly fitted without touching	Uncomfortable after 1 hour	Short term. Easily carried
Disposable Plugs (Silaflex, E.A.R., or Decidamp)	Comfortable. Universal fit. Effective if properly used	Easily soiled. Relatively expensive. Often poorly inserted, reducing effectiveness	Typically short term, but comfortable for extended wear
Circumaural Muffs	Comfortable. May be worn over plugs. Most universal fit for most users	Expensive. Heavy. Difficult to carry. Fit may be compromised by long hair or eyeglasses	Long or short-term

One single type of hearing protective device will not meet the needs of all noise-exposed personnel. The appropriate type of hearing protective device should be selected based upon a consideration of the factors listed above in addition to the degree of attenuation required in a particular situation. The most convenient method of making this determination is the Noise Reduction Rating (NRR) developed by the Environmental Protection Agency (EPA). The NRR is usually shown on the hearing protector package. The NRR is then related to an individual worker's noise environment in order to assess the adequacy of the attenuation of a given hearing protector.